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Abstract

CONDITIONING BY DISPERSION IN ASPHALT AND GROUND DISPOSAL OF MEDIUM ACTIVE CONCENTRATES

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The final storage of medium active waste concentrates has been studied under two essential aspects, the migration and dispersion of radioelements into the soil and also the conditioning or insolubilization of wastes before storage.

Migration and dispersion of radioelements in sandy soils :

The study of migration of radioelements in sandy soils required the development of both reproducible and accurate sampling techniques. These techniques are based on ion exchange or on imbibition on hygroscopic materials.

Laboratory studies on physico-chemical characteristics of soil materials led to a preliminary evaluation of the sorption capacity of the soil for radionuclides.

As a next step Sr^{89} and Cs^{137} were injected into the ground-water table and, using the above mentioned equipment, the evolution of the radioactive cloud has been determined.

The results of these experiments presented under the form of hydrodynamic and physico-chemical dispersion coefficients confirm to a large extent the laboratory studies both for migration rate and for the shape of the radioactive cloud.

The migration of radionuclides in a non-saturated profile is a much more complicated phenomenon. It has been demonstrated that there exists a gradual transition from plug flow to mixing flow.

The existence of preferential pathways became evident.

Finally the use of glauconite, lignite or phosphatic solutions as a barrier against radioelement migration has been discussed.
The application of such a technique improves the storage capacity of a site but represents also a supplementary protection around particularly hazardous nuclear facilities.

Insolubilization prior to storage :

Treatment concentrates, both liquid and solid, can be insolubilized by violent stirring in asphalt at a temperature of 200°C. This process completely dries the active material and produces after cooling a homogeneous mixture, practically insoluble in any natural medium. The dry matter content may amount up to 50 % of the mixture.

The pilot installation has an evaporation capacity of 25 litres water per hour and has successfully been operated during 18 months, both for insolubilization of semi-solids (65 % of moisture) and for the evaporation of liquid sludge or various solutions.

The radioactivity of the off gases , after purification by an electrofilter, represents about 10^{-5} of the input activity. Insolubilized blocks

of 200 litres, stored in the ground-water table at pH 4, showed no alteration after one year.
The radioactivity eluted during this period corresponds to a diffusion coefficient $D = 3.10^{-9} cm^2/day$.

The working expenses have been reported in detail and represent about 5 % of the total cost of the water treatment.

Owing to the results of these studies we have elaborated a storage program for radioactive concentrates at Mol located in a sandy profile and an area with a relatively dense population.